Marginal Bone Loss Around Early-Loaded SLA and SLActive Implants: Radiological Follow-Up Evaluation Up to 6.5 Years

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Abstract: PURPOSE The aim of this study was to compare marginal bone loss around early-loaded SLA and SLActive tissue-level implants (Straumann Dental Implants; Institut Straumann AG, Basel, Switzerland) after a mean of 81-month follow-up period. MATERIAL AND METHODS One hundred seven SLA and 68 SLActive implants were placed in 55 patients and loaded with final restoration after 8 and 3 weeks of healing time, respectively. Marginal bone loss around implants was determined radiographically at initial and after a mean observation time ranging between 20 and 81 months. The effect of location (mandible vs maxilla), smoking habit, sex, implant length and diameter, and the type of prosthesis on the marginal bone loss was evaluated. RESULTS The overall cumulative survival rate was 98.2% being 99% for SLA implants and 97% for SLActive implants. After 20-month follow-up period, mean marginal bone loss values for the SLA and SLActive implants were 0.24 and 0.17 mm, respectively. After 81 months, mean marginal bone loss for the SLA and SLActive implants reached 0.71 and 0.53 mm, respectively. Marginal bone loss was affected by the length and type of implant and patients' smoking habit after a mean observation time of 20 months. However, none of the parameters had any significant effect on the marginal bone loss after a follow-up period of 81 months. CONCLUSION With both SLA and SLActive implants, successful clinical results could be achieved up to 6.5 years of follow-up period.

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Marginal Bone Loss Around Early-Loaded SLA and SLActive Implants: Radiological Follow-Up Evaluation Up to 6.5 Years

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Purpose: *The aim of this study was to compare marginal bone loss around early-loaded SLA and SLActive tissue-level implants (Straumann Dental Implants; Institut Straumann AG, Basel, Switzerland) after a mean of 81-month follow-up period.*

Material and Methods: *One hundred seven SLA and 68 SLActive implants were placed in 55 patients and loaded with final restoration after 8 and 3 weeks of healing time, respectively. Marginal bone loss around implants was determined radiographically at initial and after a mean observation time ranging between 20 and 81 months. The effect of location (mandible vs maxilla), smoking habit, sex, implant length and diameter, and the type of prosthesis on the marginal bone loss was evaluated.*

Results: *The overall cumulative survival rate was 98.2% being 99% for SLA implants and 97% for SLActive implants. After 20-month follow-up period, mean marginal bone loss values for the SLA and SLActive implants were 0.24 and 0.17 mm, respectively. After 81 months, mean marginal bone loss for the SLA and SLActive implants reached 0.71 and 0.53 mm, respectively. Marginal bone loss was affected by the length and type of implant and patients' smoking habit after a mean observation time of 20 months. However, none of the parameters had any significant effect on the marginal bone loss after a follow-up period of 81 months.*

Conclusion: *With both SLA and SLActive implants, successful clinical results could be achieved up to 6.5 years of follow-up period. (Implant Dent 2017;26:592–599)*

Key Words: bone resorption, implant length, smoking, survival

The clinical success of oral implants depends on minimizing the amount of marginal bone loss after several years of functional loading.[1–3] In most studies, treatment outcome has been determined for each implant system individually with various follow-up periods and established for particular follow-up parameters.[4] There have also been some comparative studies on different implant systems with different implant surface properties.[5,6] Surface topography and roughness of the titanium may have a significant effect on the host response to the implant. Rough surface topography seems to allow close contact with blood clots permitting migration and differentiation of precursor osteogenic cells, which are responsible for bone formation directly at the implant surface. One study showed that implants with a rough surface exhibit a greater bone-to-implant contact (BIC) rate compared with implants having a polished surface.[7] Another study found that the surface chemistry and its wettability is another important factor affecting periimplant bone apposition by improving early contact between the implant surface and the biological environment.[8]

Most recently, a chemically modified, sand-blasted, large grit and, acid-etched (SLActive) titanium surface has been designed with the aim of enhancing bone apposition.[9] The specific production method used for modSLA surfaces aimed to create a chemically active surface with a small amount of hydrocarbons and carbonates. This hydroxylated/hydrated modSLA surface was revealed to have an initial advancing water contact angle of 0°, indicating its immediate wettability and ultra-hydrophilic character.

The chemical modification of the implant surface such as the modified SLA-surfaced (modSLA) implants can

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Table 1. Distribution of Patients, Implants, and Restorations According to Study Parameters (Sex, Age, and Smoking Habit of Patient, Implant Type, Length and Diameter, Type of Restoration, and Jaw Type)

	Sex		Age		Smoking habit	
Patients	Male	Female	Mean	Range	Nonsmoker	Smoker
	34	21	50	20–65	33	22

	Type		Location		Diameter		Length	
Implants	SLA	SLActive	Maxilla	Mandible	<4 mm	>4 mm	<10 mm	>10 mm
	107	68	77	98	82	93	23	152

Restoration	Fixed Prosthesis	
Single	Short Bridge (3 or Fewer)	Long Bridge (More Than 3)
66	35	13

transform a hydrophobic surface into a hydrophilic surface, and thereby induce nanorough surfaces. Numerous studies demonstrated that the bone response is influenced by the implant surface topography and that rough implant surfaces lead to a stronger BIC. When the implant comes in contact with blood, the hydrophilic behavior of the (modSLA) surface becomes chemically more reactive and an intimate conditioning layer is formed. The (SLActive) implant has a greater BIC at 2 and 4 weeks compared with SLA surface. Human and animal histologic studies have also demonstrated that moderately rough SLActive surface contributed to an optimal osseointegration.[10–12]

Despite the fact that the relationship between early osseointegration success and modSLA surface has been clarified, it remains to be investigated whether there is a relationship between marginal bone loss of early loaded implants and modSLA surface. The aim of this study was to evaluate marginal bone loss around the early-loaded SLA (SLA, Straumann Dental Implants; Institute Straumann AG, Basel, Switzerland) and SLActive implants (SLActive, Straumann Dental Implants) up to 6.5 years. The following hypothesis were tested: SLActive implants would result in less marginal bone loss than SLA implants and that some implant and patient-related parameters such as smoking habits, sex, location (maxilla vs mandible), implant length and diameter would affect the marginal bone loss around both types of implants.

Table 2. Mean Marginal Bone Loss Values (mm) and SDs According to Study Parameters (Sex, Age, and Smoking Habit of Patient, Implant Type, Length and Diameter, Type of Restoration, and Jaw Type) After 20- and 81-Mo Follow-Up Periods

	20 Mo		81 Mo	
Marginal Bone Loss (mm)	Mean ± SD	*P*	Mean ± SD	*P*
Implant type				
SLA	0.24 ± 0.17	0.001*	0.71 ± 0.35	0.206
SLActive	0.17 ± 0.16		0.53 ± 0.28	
Sex				
Male	0.23 ± 0.18	0.059	0.72 ± 0.45	0.208
Female	0.19 ± 0.17		0.54 ± 0.27	
Smoking habit				
No smoking	0.17 ± 0.11	0.000*	0.53 ± 0.27	0.079
Smoking	0.26 ± 0.21		0.77 ± 0.37	
Jaw				
Mandible	0.21 ± 0.19	0.842	0.69 ± 0.45	0.739
Maxillae	0.21 ± 0.16		0.61 ± 0.32	
Implant length				
>10 mm	0.16 ± 0.11	0.028*	0.42 ± 0.19	0.221
<10 mm	0.22 ± 0.18		0.68 ± 0.47	
Implant diameter				
<4 mm	0.20 ± 0.16	0.324	0.56 ± 0.29	0.525
>4 mm	0.22 ± 0.19		0.71 ± 0.44	
Type of prosthesis				
Single	0.20 ± 0.18	0.166	0.75 ± 0.45	0.439
Short bridge (3 or fewer)	0.20 ± 0.15		0.59 ± 0.30	
Long bridge (more than 3)	0.24 ± 0.20		0.53 ± 0.28	

*$P < 0.05$.

MATERIALS AND METHODS

Selection Criteria for the Patients

Patients participating in the study provided written, informed consent to the treatment, and agreed to attend for follow-up clinical visits, including postoperative radiographs. All patients were partially edentulous in the posterior regions of the maxilla and/or mandible, displaying a single-tooth gap, an extended edentulous space, or a distal extension situation. The opposing dentition consisted of completely or partially removable dentures, natural teeth or implant-supported restorations. All implantation regions required a minimum of 4 months of healing time after tooth extraction (Table 1).

The medical history of each patient was evaluated at the initial and recall examinations, and only healthy patients were included in the study. Patients with certain systemic diseases, such as diabetes mellitus and osteoporosis, were included in the study. Smoking and bruxism were recorded but were not considered as a contraindication to treatment. Patients were informed that smoking is associated with an increased risk of implant failure. Before insertion

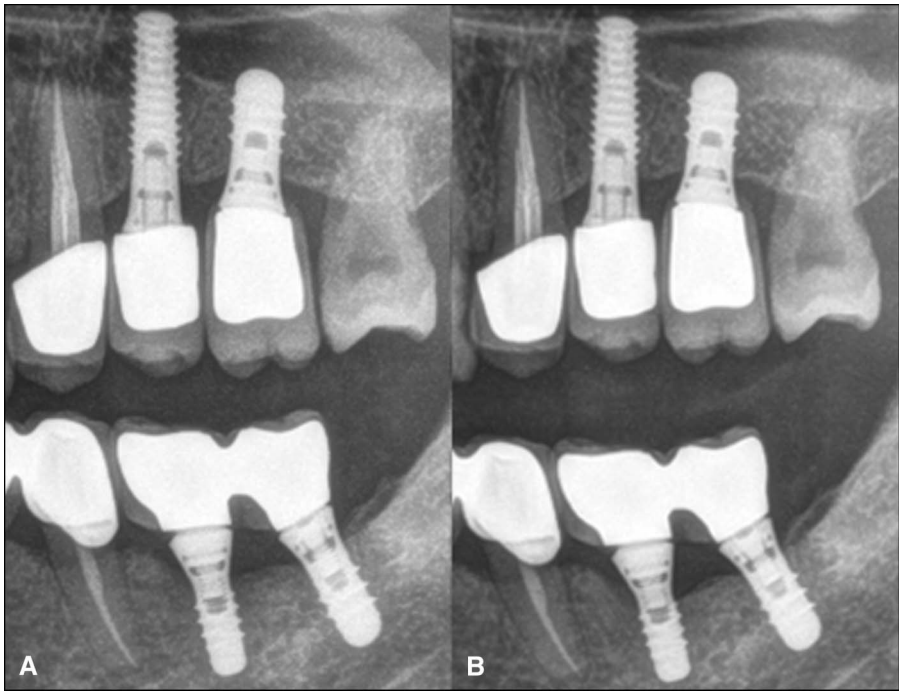

Fig. 1. A and **B**, Radiographs of SLA implants after a mean observation period of (**A**) 26-month follow-up period and (**B**) 85-month follow-up periods. Note the marginal bone loss after 85 months in Figures 1B and 2B.

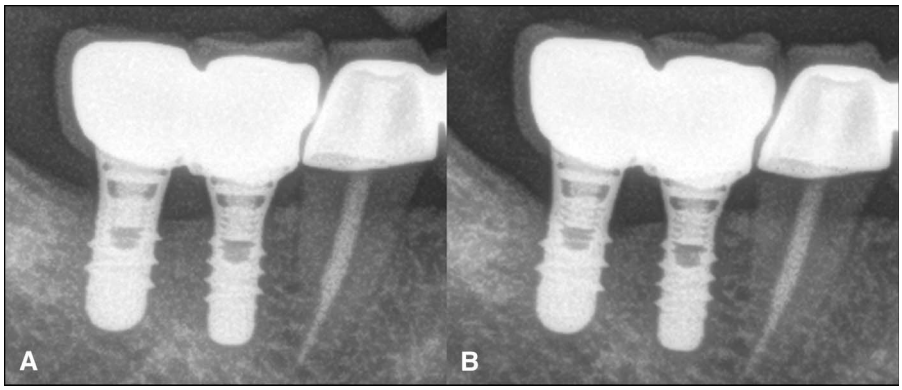

Fig. 2. A and **B**, Radiographs of SLA implants after a mean observation period of (**A**) 26-month follow-up period and (**B**) 85-month follow-up period. Note the marginal bone loss after 85 months in Figures 1B and 2B.

of the implants, patients underwent examinations to evaluate any periodontal disease, caries, and soft tissue disorder. They also received appropriate treatment and oral hygiene instruction. Panoramic radiographs were obtained before implant insertion.

Surgical and Prosthetic Procedures

Surgery was performed under local anesthesia following the standard Straumann one-stage surgery protocol. A crestal incision was made and full-thickness flaps were raised. The implant was placed in the recipient site using an insertion device and a hand ratchet or motor drive. Any patient with implants lacking primary stability or with inadequate bone at surgery was excluded from further participation in the study. Healing abutments were inserted for transmucosal healing. Sutures were removed 1 to 2 weeks after surgery. Patients were treated with an antibiotic regimen consisting of 500 mg amoxicillin twice daily for 5 days starting 1 hour before surgery. They were instructed to rinse with a 0.1% chlorhexidine solution twice a day for 1 or 2 weeks until suture removal. Analgesics were given as required for pain control. None of the patients wore any provisional prosthesis during the osseointegration period.

Thirty-five International Team for Implantology (ITI) SLActive implants (51.5%) were placed in the mandible and 33 (48.5%) in the maxilla, whereas 63 SLA implants (58.9%) were placed in the mandible and 44 (41.1%) in the maxilla. Group I consisted of 107 SLA implants loaded after 8 weeks' healing time and Group II consisted of 68 SLActive implants loaded after 3 weeks of healing time.

All patients received fixed dental prosthesis (FDP). The distribution of restorations was as follows: three-unit FDPs in the maxilla or mandible (11 patients, 70 implants), single-tooth crowns in the maxilla or mandible (38 patients, 66 implants), and multiple-unit FDPs in the maxilla or mandible (6 patients, 39 implants).

After a healing period of 3 weeks in the SLActive implant group, the patients were recalled for restorative treatment. The prosthetic procedures initially involved making an impression using the closed-tray technique with a polyether impression material. Permanent metal-porcelain FDPs were cemented 3 or 4 weeks after surgery. In the SLA implant group, final metal-porcelain FDPs were placed after a healing period of 8 weeks.

Clinical and Radiographical Examination

Standardized digital panoramic radiographs (Orthophos XG; Sirona Dental Systems, Bensteim, Germany) were obtained firstly at the time of implant placement and at a mean of 20 and 81 months after loading to calculate the changes in bone level at the mesial and the distal sites of the implants. The distance from the implant shoulder to the first BIC was measured to calculate the marginal bone loss by a single independent calibrated examiner. The anatomical magnification and distortion

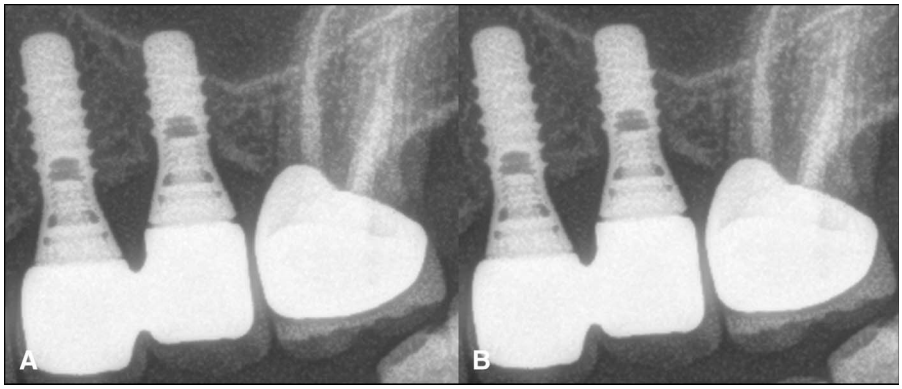

Fig 3. **A** and **B**, Radiographs of SLActive implants after a mean observation period of (**A**) 21-month follow-up period and (**B**) 82-month follow-up period. Note the marginal bone loss after 82 months in Figures 3B and 4B.

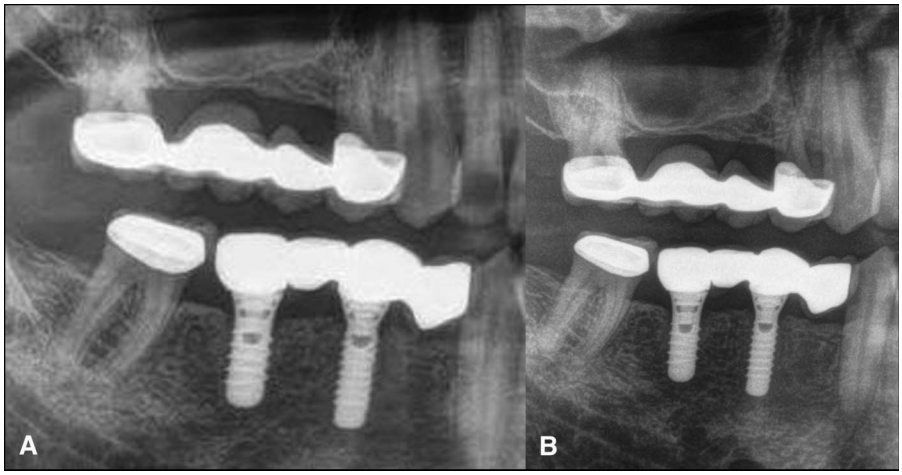

Fig. 4. **A** and **B**, Radiographs of SLActive implants after a mean observation period of (**A**) 21-month follow-up period and (**B**) 82-month follow-up period. Note the marginal bone loss after 82 months in Figures 3B and 4B.

of the radiographs was calibrated in accordance with the clinical data (height and width) for each implant and known distance between 2 implant threads. A simple mathematical calculation was done to calibrate and recalculate each linear marginal bone loss measurement according to the radiographic image size.[13] Marginal bone loss was compared between the 2 groups according to the following parameters: implant diameter and length, sex of the patients, unit numbers of prosthesis, location of the implants (maxilla vs mandible) and smoking habit of the patients (Table 2).

Implant success was defined according to Buser et al[14] as absence of (a) persistent pain, foreign body sensation, and/or dysesthesia; (b) recurrent periimplant infection with suppuration; (c) implant mobility; and (d) continuous radiolucency around the implant.

Statistical Analysis

Implant survival curves were calculated according to the product-limit method (Kaplan-Meier algorithm). Time zero was defined as the date of initial placement of the implant. Surviving implants were included in the total number with a risk of failure only up to the time of their last follow-up examination. Therefore, the success rate changed only when a failure occurred. Statistical analysis was performed using SPSS Statistics software package (IBM SPSS Inc., Chicago, IL). Descriptive statistics (mean, range, and SDs) were based on measurements obtained from the implants. The bone loss value in the 2 groups was compared statistically by means of one-way ANOVA. $P < 0.05$ was considered statistically significant for all tests.

RESULTS

Table 1 shows the distribution of patients, implants, and restorations. A total of 55 patients, 34 males, and 21 females received 107 SLA implants and 68 SLActive implants. The age of the patients ranged between 20 and 65 years. The number of nonsmoker patients was higher than the number of patients who smokein the study group. Ninety-eight implants were placed in the maxilla and 77 implants in the mandible. The bone sink depth of the implants ranged between 6 and 14 mm, and the diameters between 3.3 and 4.8 mm in different areas. Diameter of the placed implants was less than 4 mm in 82 implants and more than 4 mm in 93 implants. The number of implants longer than 10 mm in length constituted more than two thirds of the total implants placed. The number of single implant restoration was approximately more than half of the total restored implants.

All implants were osseointegrated. However, 2 male patients and 1 female patient who were heavy smokers lost their implants after 73, 50, and 68 months, respectively. One SLA- and 2 SLActive-failed implants were $\geq$10 mm long and $\geq$4.1 mm diameter and restored with single and 3 unit FDPs, respectively. All of these implants were removed because of the periimplantitis and mobility. The overall cumulative survival rate was 98.2, being 99% for SLA implants and 97% for SLActive implants.

Table 2 presents mean marginal bone loss values of the implants according to the study parameters after a mean of 20- and 81-month follow-up periods. The mean change in the bone level was 0.24 $\pm$ 0.17 mm for the SLA and 0.17 $\pm$ 0.16 mm for the SLActive implants after a mean of 20-month follow-up, showing a significant difference between the 2 groups ($P < 0.001$). After a mean of 81 months, mean marginal

bone loss was 0.71 ± 0.35 and 0.53 ± 0.28 mm for SLA and SLActive implants, respectively. However, difference between the groups was not statistically significant ($P > 0.05$) (Figs. 1–4).

The mean marginal bone loss was 0.23 ± 0.18 mm and 0.19 ± 0.17 mm after a mean of function of 20 months, and 0.72 ± 0.45 and 0.54 ± 0.27 mm after a mean of 81 months in the male and female groups, respectively. The difference between the groups was not statistically significant at both follow-up periods ($P > 0.05$).

The mean marginal bone loss was 0.17 ± 0.11 mm and 0.26 ± 0.21 mm after a mean of 20 months, and 0.53 ± 0.27 mm and 0.77 ± 0.37 mm after a mean of 81 months in nonsmoker and smoker groups, respectively. Smoking habit significantly affected the marginal bone loss around the implants in the 20-month follow-up period ($P < 0.05$). However, no statistically difference was found in marginal bone loss between smoker and nonsmoker groups after a mean of 81 months.

Mean marginal bone loss did not significantly differ between the implants placed in the mandible or in the maxilla after a mean of 81 months ($P > 0.05$). The diameter of implants did not have any effect on the marginal bone loss around the implants at both follow-up periods. However, the loss of marginal bone in implants longer than 10 mm was significantly less than those implants shorter than 10 mm, after a mean observation period of 20 months ($P < 0.05$).

The implants used consisted of 66 single tooth crowns, 35 with 3 unit or fewer unit, and 13 with 4 or more unit FDPs. The type of prosthesis did not affect marginal bone loss around the implants at both follow-up periods ($P > 0.05$).

DISCUSSION

Conventional implant loading protocols recommend a 12-week or longer period of undisturbed healing after implant placement to minimize the risk of complications.[15] Much shorter restoration periods have become more widely accepted and practiced in recent years, especially, as a result of reported success rates, modification of the implant surfaces, patient demands for esthetic, and functional restoration as soon as possible after surgery.[16–19]

Experiments have demonstrated that SLActive implants significantly influence cell differentiation and growth factor production *in vitro*[9] and improve early stages of osseointegration in animals when compared with SLA implants.[20] These healing characteristics have been investigated in a human experimental study with SLA and SLActive implants and improved bone-to-implant contact was documented for SLActive implants surface compared with SLA implants after 14 and 28 days.[10]

Oates et al[21] reported an increase in the implant stability after 2 weeks for the SLActive implants and 4 weeks for the SLA implants in a clinical study. Another clinical study[22] that compared the SLA and SLActive implants reported higher survival rate for the SLA implants. In contrast, in one other study,[23] lower success rate was noted for the SLA implants comparing SLActive implants in 3-year follow-up period.

The clinical findings of 3 studies, with 72 SLA implants after immediate and early loading, 104 SLA implants, and 106 SLA implants after early loading, demonstrated favorable results, with 5-year success rates of 100%, 99%, and 99%, respectively.[24–26] Another study also reported high success rate for the SLA implants in periodontally compromised patients in 10-year follow-up period.[27] Furthermore, 2 studies reported high success rate for the SLActive implants after a 3-year period.[28,29] One of the latest study with 40 SLActive short implants reported 100% survival rate at 5-year follow-up period.[30] Finally, a systematic review published on SLA and SLActive implants comparing the clinical results in early and immediate loading protocols reported survival rates of 95% and 97%, respectively.[31] The result of our study showing 97% survival rate for SLActive implants and 99% for SLA implants over a period of 81 months demonstrated similar survival rate to those of the previous studies.

One clinical study showed that marginal bone loss for immediate and early loaded SLA implants were 0.01 ± 0.18 mm, 0.08 ± 0.31 mm after 1 year and 0.4 ± 0.24 mm and 0.8 ± 0.19 mm after 5- year follow-up period, respectively.[24] Another recent study[28] compared marginal bone loss around immediate and early loaded SLA implants in 36-month follow-up and reported 0.88 ± 0.82 mm marginal bone loss in the immediate loading group and 0.57 ± 0.84 mm in the early loading group.

Two studies evaluated marginal bone level changes with immediately and early loaded SLActive implants and reported that the overall mean bone level changes were 0.90 ± 0.90 and 0.81 ± 0.89 mm in the immediately loaded groups, 0.63 ± 0.95 mm and 0.56 ± 0.73 mm in early loaded groups, for 12- and 5-month follow-up periods, respectively.[32,33] However, in another study,[23] lower bone level change was noted for SLActive implants, namely a marginal bone loss of 0.12 mm after 3 years. In the present study, marginal bone loss around SLA and SLActive implants was 0.71 ± 0.35 and 0.53 ± 0.28 mm, respectively, after 81 months of clinical examination. Although our follow-up period was longer than previous studies, lower marginal bone loss was observed for both SLA and SLActive implants. This may be the result of some factors such as patient selection, good oral hygiene, and location of the restorations.

A comparative study of SLA and SLActive implants reported that marginal bone loss in the loading stage was 0.22 ± 0.06 and 0.18 ± 0.05 mm and after 1 year which was increased to 0.46 ± 0.07 mm and 0.43 ± 0.11 mm for SLA and SLActive implants, respectively.[22] In the present study, marginal bone loss around the SLActive implants was similar to the reported values in former studies. A recent comparative histological study with SLA and SLActive implants concluded that the use of an activated implant surface did not increase bone-to-implant contact compared with conventional implants.[34] In addition, a recent review which included 1394 SLA and 145 SLActive implants

reported no significant differences in relation to implant loss or clinical parameters between the immediate/early loading and delayed loading protocols.[31]

It is well known that in comparison to the mandible because of a different bone quality which is more trabecular and softer in nature, maxilla as a location limits the success rates, especially, in immediate or early loading.[35] Nevertheless, the location being either the mandible or the maxilla, patient's sex did not show any statistical correlation with mean marginal bone loss. These findings are in agreement with the results reported by Carlson et al.[36] and Eliasson et al.[37] However, one retrospective study involving 141 ITI implants in 66 patients showed that the survival and success rates of implants placed in male patients and in the maxilla were lower than those of the implants placed in female patients and in the mandible.[38]

Smoking also affects the complication rates of implants. Previous studies have shown that the failure rate of implants in smokers is higher than in nonsmokers.[39,40] A recent study[41] determined greater marginal bone loss among smokers similar to numerous previous studies.[39,40,42,43] Lindquist et al[42] in a 10-year follow-up study of mandibular implant-supported prostheses found that marginal bone loss was greater in smokers than in nonsmokers and correlated with the amount of cigarette consumption. Two latest long-term implant survival studies concluded that smoking was significantly related to increased implant failure.[44,45] Recent gene study results supported the hypothesis that some bone markers in the alveolar tissue are modulated by smoking, which could explain the negative impact of smoking on bone healing.[46] In the present study, we found that smokers had significantly greater mean periimplant marginal bone loss along the follow-up period compared with nonsmokers and all of the 3 patients who lost their implants were heavy smokers.

Several previous studies demonstrated that shorter implants tended to fail significantly more often after uncovering and after loading than longer implants.[47–49] Wenget al[48] reported that 60% of all failed implants were short ($\leq$10 mm), and that the cumulative success rate for these short implants was significantly lower than the cumulative success rate for all implants. In a study by Herrmann et al,[49] a significant correlation was demonstrated between shorter implants and failure rate. However, other studies found that the failure rates of short implants were similar to those of longer ones. This finding was observed with 7-mm long implants placed in partially dentate patients,[50] 7-mm long implants placed in the mandible, and when the 7-mm implant was not the most distal in an FDP.[51] Moreover, in other studies[52–57] which provided data on implant length, this was not reported as influencing the survival rate. In the present study, the implant length had a positive effect on marginal bone loss in 20-month follow-up period but this effect was no longer observed at later follow-up time. Recently, similar results also showed that implant length had a positive influence on primary implant stability but this influence was no longer observed at later time points of measurement.[24]

Ivanoff et al.[58] reported failure rates of 5%, 3%, and 18% for 3.75-, 4-, and 5-mm-diameter implants, respectively. The lowest cumulative survival rates were seen with 4- and 5-mm-diameter implants placed in the mandible (84.8% and 73%, respectively). On the other hand, one study[47] reported that the percentage failure for implants with diameters $>$3 mm was higher at each stage compared with those with a diameter $>$4 mm. In other studies, implant failure did not seem to be significantly influenced by the diameter.[51,56,57,59] As such, in the study by Friberg et al,[59] the failure rates were 5.5%, 3.9%, and 4.5% for 3.75-, 4-, and 5-mm-diameter implants, respectively. Bone loss around narrow-diameter implants was within the same limits as those reported around standard-diameter implants. In our study, we also found that the diameter of the implants did not have a significant effect on the marginal bone loss around the implants.

In this study, the first 20 months were considered as a critical time point for early failures and 80 months which almost correspond to 6.5 years as late failures. The lack of annual measurements could be considered as a limitation of this study, but, interestingly, long-term results seemed to offset the importance of parameters that could affect the survival of implants and implant-borne FDPs which could be considered one important outcome of this study.

Overall, the studies reported similar outcomes for both SLA and SLActive surfaces, independent of the loading protocol. It could be anticipated that the modified SLA surface would demonstrate the same long-term efficacy as the regular SLA implants because the 2 implant surfaces are characterized by the same surface topography. The surfaces differ only in their surface chemistry and hydrophilicity.[31]

Conclusions

Up to 20 months, implant type, smoking, and implant length significantly affected the marginal bone loss, but after a mean follow-up period of 81 months, the amount of marginal bone loss was not affected by the diameter and length of the implants, location (maxilla vs mandible), length of the restoration, and sex of the patients and their smoking habits.

Roles/Contributions by Authors

I. D. Şener Yamaner: structuring the method, guidance of research, writing the manuscript, coordinating the group that conducted out the study, reviewing the literature, providing patients or material, and working in the routine function. G. Yamaner: structuring the method, guidance of research, coordinating the group that conducted out the study, collecting data, providing patients or material, and working in the routine function. A. Sertgöz: structuring the method, guidance of research, coordinating the group that conducted out the study, reviewing the literature, collecting data, and providing patients or material. C. F. Çanakçı: structuring the method, guidance of research, coordinating the group that conducted out the study, collecting data, providing patients or material, and working in the

routine function. M. Özcan: structuring the method, guidance of research, writing the manuscript, coordinating the group that conducted out the study, reviewing the literature, and working in the routine function.

DISCLOSURE

The authors claim to have no financial interest, either directly or indirectly, in the products or information listed in the article.

APPROVAL

This study was conducted according to the approval of the Ethical Committee of the Faculty of Dentistry Atatürk University. (E.K.09.2015-036).

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